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(19) **United States**(12) **Patent Application Publication****Thomas et al.**(10) **Pub. No.: US 2015/0003548 A1**(43) **Pub. Date:****Jan. 1, 2015**(54) **VERTICAL BEAM DESIGN FOR  
UE-SPECIFIC BEAMFORMING BY  
MATCHING TO A CB**(52) **U.S. Cl.**CPC ..... **H04B 7/0478** (2013.01)USPC ..... **375/267**(71) Applicant: **Nokia Siemens Networks Oy**, Espoo  
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(57) **ABSTRACT**

A method includes transmitting reference signals to user equipment from an active antenna array system including a multiple of antennas arrayed in at least a vertical direction. The active antenna array system is configured to perform the transmitting of the reference signals using multiple vertical beams having vertical patterns designed to provide desired vertical patterns after codebook feedback from a codebook is applied on transmissions from logical ports of the antenna array. The method includes receiving codebook feedback from the user equipment in response to transmitting the reference signals. The method includes transmitting information to the user equipment at least by applying selected entries of the codebook corresponding to the codebook feedback to the logical ports of the antenna array, wherein application of the selected entries causes the active antenna array system to perform transmitting information using multiple beams having the desired vertical patterns. Apparatus and program products are disclosed.

